

TC 3.11 HYDROLOGIC AND HYDRAULIC ANALYSIS AND STREAM DESIGN PERFORMANCE SPECIFICATION**3.11.01 General**

The Design-Build Team (DBT) shall study, analyze, design, obtain permit modifications and approvals and construct the stream in accordance with requirements of this specification, including performance requirements, standards and references, design and construction criteria, maintenance during construction, and required submittals.

Analyze the hydrology and hydraulic conditions of the Upper Little Patuxent River for use in the overall design and to secure regulatory agency approvals for the project.

Upper Little Patuxent is located in Maryland watershed 02-13-11 and drains to the Middle Patuxent and then into the Patuxent River. Upper Little Patuxent River is classified as Use IV-P stream according to the Code of Maryland Regulations (COMAR) and in stream construction may not occur during the period of March 1 through May 31, inclusive of any year.

The Design-Builder shall provide a Maryland registered Professional Engineer with a minimum of ten (10) years of bridge design experience. The administration reserves the right to request a resume to verify said qualifications.

3.11.02 Guidelines and References**3.11.02.01 Guidelines**

The study, analysis, design, permit modification, construction and required surveys shall be in accordance with this performance specification and the relevant requirements of the following Guidelines listed in Table 1, unless otherwise stipulated in this specification. Guidelines specifically cited in the body of this performance specification establish requirements that shall have precedence over all others. Should the requirements in any Guideline below conflict with those in another, the Guideline listed with the higher priority shall govern.

It shall be the DBT responsibility to obtain clarification for any unresolved or perceived ambiguity prior to proceeding with design or construction.

Use the most current version of each listed Guideline, including interim revisions, as of the initial publication date of this RFP unless modified by addendum or change order.

Table 1

Guidelines

Priority	Author or Agency	Title
1	SHA	Office of Structures Manual on Hydrologic and Hydraulic Design
2	SHA	SHA/MDE Application of Hydrologic Methods in Maryland, September 2010
3	MDE	Code of Maryland Regulations Title 26.17.4 Water Management
4	MDE	Code of Maryland Regulations Title 26.08.02 Water Quality
5	MDE	Maryland's Waterway Construction Guidelines
6	ACOE	HEC-RAS Software, Version 4.0
7	FEMA	Conditional Letter of Map Revision (CLOMR)
8	SHA	Office of Structures, Policy and Procedure Manual
9	SHA	Office of Structures, Structural Standards Manual, Volumes I and II
10	SHA	Special Provisions and Special Provision Inserts to the Standard Specifications
11	SHA	Standard Specifications for Construction and Materials

3.11.03 Design Requirements

Design calculations shall be performed in Customary U.S. units. Only Customary U.S. units shall appear on the plans.

3.11.03.01 Structure Hydrology and Hydraulics

3.11.03.01.01 Existing and Ultimate Conditions Hydrology

MDE-approved peak discharges will be needed for, at a minimum, the 2-, 10-, and 100-year flows to obtain a waterway construction permit. These discharges must be determined in accordance with the MDE/SHA Hydrology Panel recommendations. The DBT will need to build a divided WinTR-20 model to determine discharges at all three required reaches and the timing of the peak flows. The DBT may determine that additional discharges are helpful in determining a design. Discharge points are needed at a minimum for the upper reach, tributary and the lower reach.

3.11.03.01.02

Hydraulic Analysis

The DBT is responsible for the following:

A. Hydrology and Hydraulics Analysis Procedures

The DBT is to perform all hydrology and hydraulic studies to secure MDE permit modifications and approvals for the proposed work. At minimum the studies shall include the following items:

- 1) The Hydrologic Analysis Study and Report for the existing and ultimate land use conditions.
- 2) A geomorphic assessment of the reaches.
- 3) The Hydraulic Analysis Study and Report for the existing and proposed conditions as well as the surveys needed to complete the hydraulic studies.
- 4) Surveys needed to complete the hydraulic study

The Office of Structures (OOS) Manual for Hydrologic and Hydraulic Design, has been provided in electronic format on ProjectWise with the Design-Build (DB) contract package.

B. Communication

The DBT is encouraged to work in close cooperation with the OOS to establish and maintain good communication to result in productive work. The DBT must hold 2 coordination meetings with OOS and EPD representatives at key decision points in the study developments including, but not limited to, locating hydraulic cross-sections and hydrologic model sub-division in the existing conditions model development and after the completion of the proposed conditions modeling for final review and approval. As part of this communication a copy of the DBT's CPM schedule and updates shall be sent to OED concurrently with submission to District Construction.

C. Requirements for DBT Hydrologic and Hydraulic Reports

The Hydrology and Hydraulic Analysis Reports shall contain the completed text, exhibits, summary tables, computer output data, and other technical information. The format and content of report shall be prepared in conformance with the instructions in the OOS Manual for Hydrologic and Hydraulic Design and any other instructions from the SHA's Project Team. The DBT shall determine the impacts the proposed project would have on the hydraulic characteristics such as water surface elevations, flow velocities, Froude numbers and shear stress in the channel.

All DBT study reports shall be self-contained documents to the extent

practicable. When necessary, reference may be made to outside sources of information used by the DBT in their preparation of data or exhibits for the reports. All references shall be clearly stated, listed and described as related to the Hydraulic Analysis Report. All the pages within the report shall be numbered, dated and shall be placed in an 8 ½-inch by 11-inch, three-hole binder.

Upon completion of the Hydrologic and Hydraulic Analysis Reports, the DBT shall submit the report to SHA's Structure Hydrology and Hydraulics Unit and the Environmental Programs Division for review and concurrence prior to submittal to MDE. The DBT shall submit the Hydrologic Analysis Report and the Hydraulic Analysis Report to MDE for review and approval and copy SHA. Upon approval from MDE, the DBT shall provide two copies of the final approved report and files on CD, and the notification of MDE approval to the OOS Structure Hydrology and Hydraulics Unit.

3.11.03.01.03 FEMA Hydraulics and CLOMR Requirements

3.11.03.01.03.01 FEMA Floodplain Designation

- A. Little Patuxent River has a designated FEMA Special Flood Hazard Area (SFHA) A9 floodplain, as shown on the Flood Insurance Rate Map (FIRM) for Howard County, Maryland, Community-Panel Number 240044 0023 B, dated December 4, 1996 and the website www.mdfloodmaps.org. The tributary has a designated FEMA Special Flood Hazard Area (SFHA) A7 floodplain.
- B. FEMA Floodplain Map Change Requirements: The proposed design may impact the FEMA-regulated 1-percent annual chance floodplain limits and water surface. If so, the project may require a FEMA National Flood Insurance Program NFIP permit to address the project's impact on the FEMA SFHA, such as a FEMA Floodplain Conditional Letter of Map Revision (CLOMR). The DBT, if necessary, shall prepare the FEMA permit, or CLOMR, in conformance with all applicable regulations and codes, including Federal Emergency Management Agency, Code of Federal Regulations Title 44 (Emergency Management Assistance), Parts 9, 10 and Part 72—Procedures and Fees for Processing Map Changes. The DBT shall coordinate with SHA throughout the duration of submitting and securing and meeting all subsequent requirements of the required FEMA permit. The DBT shall provide SHA with copies of the permit submission, approval and all related documents.

3.11.03.02 Channel Design and Stability Assessment**3.11.03.02.01 Channel Restoration Design and Sediment Transport**

Determine impairments of physical stability and the ecological function and values of the stream system, including the stream channel, floodplain and riparian areas. Determine a geomorphically significant design discharge(s) based on a combination of hydrologic modeling, regional hydrologic relationships, geomorphic principles and field indicators. Reference the Office of Structures Manual for Hydrologic and Hydraulic Design for Stream Morphology evaluation methodologies.

Develop a proposed channel geometry in plan form, profile and cross-section that remains stable across the range of flow events expected to produce maximum erosive forces and velocities at the site including up to the 100-YR storm event. Proposed bank stability measures must prevent continued erosion of the system and be resistant to changes induced by proposed conditions. The proposed channel design must demonstrate equilibrium of sediment transport conditions through an analysis of sediment transport competence and/or capacity. The sediment transport analysis must utilize equations, models or methods consistent with the geomorphic context and characteristics of site bed material and anticipated bedload.

The Stream Restoration Assessment and Design Report shall define the assessment methodologies, results and supporting documentation and calculations on the topics described above. The report must be provided to the Administration in draft form prior to acceptance of the proposed design.

3.11.03.02.02 In-Stream Structure Design

Design in-stream structures to stabilize the channel bed or bank within the character of the proposed design strategy. Any in-stream structures proposed and constructed by the DBT may not create a barrier for any aquatic species that may be reasonably expected to be present at the site presently or anticipated following construction. Materials for the structures must be designed to resist the range of forces and velocities in the channel in proximity to the structure(s) at discharges up to the 100 YR storm event. Design computations must be provided to the Administration indicating the resistance and/or design life of any stone, wood, or other materials integral to the structural stability of all in-stream structures, prior to final approval of the design plans. A design narrative and the computations described above must be included in the Stream Restoration Assessment and Design Report. Details and specifications depicting the materials, methods, and means of construction must be provided to the Administration in each plan submittal.

3.11.03.02.03 In-Stream Habitat Evaluation and Design

Design channel geometry, in-stream structures, floodplain and landscape elements to enhance and improve aquatic and riparian habitat. Features for aquatic and riparian species including but not limited to aquatic macroinvertebrates, fish, amphibians, reptiles and the vegetative communities are recommended. Discussions of in-stream habitat requirements will be required for permit acceptance and approval and must be included in the Stream Restoration Assessment and Design Report and approved by the Administration prior to final plan acceptance.

3.11.03.02.04 Ecological Uplift Design

To obtain a permit from the United States Army Corps of Engineers it is anticipated that the proposed design must employ strategies that describe the design and construction elements that provide ecological uplift from the existing impaired condition of the system. It is the responsibility of the DBT to provide the above information to obtain all environmental permit modification. The Functional Lift Pyramid should provide a framework for presenting this information; however, other methods for determining ecological lift can be presented. Discussions of Ecological Uplift Design requirements will be required and must be included in the Stream Restoration Assessment and Design Report and approved by the Administration prior to final plan acceptance.

3.11.03.02.05 Deliverables

The DBT must provide a Stream Restoration Assessment and Design Report and plans to the Administration. At minimum the report must include all the elements described in 3.11.03.02. The Administration must approve all design methods, computations and reporting prior to design acceptance which must occur prior to the DBT applying for permit modifications and approvals. The DBT is responsible for rectifying any deficiencies perceived by the regulatory agencies even if the Administration has approved the report prior to issuance of the required permit modifications.

The Stream Restoration Assessment and Design Report may be combined with the Hydrologic and Hydraulic Assessment Reports.

Design plans and specifications must include details to describe the structure in layout, materials, methods and means. These details and specifications must be approved by the Administration prior to plan acceptance. The specifications must be in the format of the SHA Specification Guide dated 1/26/2012.